

WHAT IS CLAIMED IS:

1. A distance detecting apparatus comprising:
  - a light emitting unit that emits a light in a light emitting direction which is the direction to an object, the light having a distributed pattern
  - 5 in a predetermined direction;
  - a photographing device that obtains an image of the object along with a photographing direction;
  - a holding mechanism that holds the light emitting unit and the photographing device in such a relation that
  - 10 (a) the photographing direction is not in a plane that includes both the light emitting direction and the predetermined direction of the distributed pattern, and
  - (b) the photographing direction is not parallel to the light emitting direction; and
  - 15 a distance deriving unit that derives a distance between the object and a predetermined position based on the image obtained by the photographing device.
2. An air bag system controlling apparatus comprising:
  - 20 a light emitting unit that emits a light in a light emitting direction which is the direction to an object seating on a seat of a vehicle, the light having a distributed pattern in a predetermined direction;
  - a photographing device that obtains an image of the object along with a photographing direction;
  - 25 a holding mechanism that holds the light emitting unit and the

photographing device in such a relation that

(a) the photographing direction is not in a plane that includes both the light emitting direction and the predetermined direction of the distributed pattern, and

5 (b) the photographing direction is not parallel to the light emitting direction;

a distance deriving unit that derives a distance between the object and a predetermined position based on the image obtained by the photographing device; and

10 an air bag system controlling unit that controls an operation of an air bag based on the distance derived.

3. The air bag system controlling apparatus according to claim 2, wherein the light emitting unit emits an infrared light, and

15 the photographing device obtains an infrared image.

4. The air bag system controlling apparatus according to claim 2, wherein the light emitting unit emits the light when an operation of the air bag system controlling unit is required, and

20 the distance deriving unit derives the distance based on the image when the light emitting unit emits the light.

5. The air bag system controlling apparatus according to claim 2, wherein the light emitting unit emits the light having a distributed

25 pattern perpendicular to the light emitting direction.

6. The air bag system controlling apparatus according to claim 2, wherein the light emitting unit emits the light having a discretely distributed pattern perpendicular to the light emitting direction.

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7. The air bag system controlling apparatus according to claim 2, wherein the distance deriving unit further comprises an identifying unit that identifies a position of the distributed pattern of the light in the image by comparing a first image that is an image when the light  
10. emitting unit emits the light and a second image that is an image when the light emitting unit does not emit the light.

8. The air bag system controlling apparatus according to claim 2, wherein the distance deriving unit further comprises:

15 a dividing unit that divides the image into a plurality of regions;  
and

an identifying unit that identifies a position of the distributed pattern of the light in the image by calculating an average of a high-luminance part in each of the regions.

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9. The air bag system controlling apparatus according to claim 2, wherein the distance deriving unit chooses, as the distance, shortest one of a plurality of distance candidates depending on a position of the object, when the plurality of distance candidates are derived from the  
25 image.

10. The air bag system controlling apparatus according to claim 2,  
wherein the light emitting unit emits the light from a front side of the  
seat.

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11. The air bag system controlling apparatus according to claim 2,  
wherein the distance deriving unit stores a relation between positions of  
the distributed pattern of the light in the image and distances, and  
derives the distance by referring to the relation stored.

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12. The air bag system controlling apparatus according to claim 2,  
wherein the distance deriving unit derives the distance based on a  
position of the distributed pattern of the light in the image, by extracting  
a high-luminance part in the image, and identifying whether the  
15 high-luminance part corresponds to the position of the distributed  
pattern of the light in the image.

13. An air bag system controlling apparatus comprising:  
a light emitting unit that emits a light in a light emitting direction  
20 which is the direction to an object the light having a distributed pattern  
in a predetermined direction;

a photographing device that obtains an image of the object  
along with a photographing direction;

a holding mechanism that holds the light emitting unit and the  
25 photographing device, in such a relation that

(a) the photographing direction is not in a plane that includes both the light emitting direction and the predetermined direction of the distributed pattern, and

5 (b) the photographing direction is not parallel to the light emitting direction;

a memory unit that stores a computer program that makes it possible to execute a function of deriving a distance between the object and a predetermined position based on the image obtained by the photographing device, and a function of controlling an operation of an  
10 air bag based on the distance derived; and

a processor that can access the memory unit and execute the computer program.

14. A distance detecting apparatus comprising:

15 a light emitting unit that emits a light in a light emitting direction which is the direction to an object, the light having a plurality of pattern lights that are parallel to each other;

a photographing device that obtains an image of the object along with a photographing direction; and

20 a distance deriving unit that derives a distance between the object and a predetermined position based on an interval between the pattern lights in the image.

15. An airbag system controlling apparatus comprising:

25 a light emitting unit that emits a light in a light emitting direction

which is the direction to an object seated in a seat of a vehicle, the light having a plurality of pattern lights that are parallel to each other;

a photographing device that obtains an image of the object along with a photographing direction;

5 a distance deriving unit that derives a distance between the object and a predetermined position based on an interval between at least two of the pattern lights in the image; and

an air bag system controlling unit that controls an operation of an air bag based on the distance derived.

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16. The air bag system controlling apparatus according to claim 15, wherein the distance deriving unit stores a relation between intervals between the distributed pattern of the light in the image and distances, and derives the distance by referring to the relation stored.

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17. The air bag system controlling apparatus according to claim 15, wherein the light emitting unit emits an infrared light, and the photographing device obtains an infrared image.

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18. The air bag system controlling apparatus according to claim 15, wherein the light emitting unit emits the light when an operation of the air bag system controlling unit is required, and

the distance deriving unit derives the distance based on the image when the light emitting unit emits the light.

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19. An airbag system controlling apparatus comprising:

a light emitting unit that emits a light in a light emitting direction which is the direction to an object seated in a seat of a vehicle, the light having a plurality of pattern lights that are parallel to each other;

5 a photographing device that obtains an image of the object along with a photographing direction;

a memory that stores a computer program that makes it possible to execute a function of deriving a distance between the object and a predetermined position based on an interval between at least two of the  
10 pattern lights in the image obtained by the photographing device, and a function of controlling an operation of an air bag based on the distance derived; and

a processor that can access the memory unit and execute the computer program.

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20. The air bag system controlling apparatus according to claim 19, wherein the light emitting unit emits a infrared light, and  
the photographing device obtains an infrared image.

20 21. The air bag system controlling apparatus according to claim 19, wherein the light emitting unit emits the light when an operation of the air bag system controlling unit is required, and

the distance deriving unit derives the distance based on the image when the light emitting unit emits the light.

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22. A method of detecting a distance, comprising:

emitting light in a light emitting direction to thereby irradiate an object, the light being having a distributed pattern in a predetermined direction;

5 obtaining an image of the object along with a photographing direction, in such a manner that

(a) the photographing direction is not in a plane that includes both the light emitting direction and the predetermined direction of the distributed pattern and

10 (b) the photographing direction is not parallel to the light emitting direction; and

deriving a distance between the object and a predetermined position based on a position of the pattern light in the image.

15 23. A method of detecting a distance, comprising:

emitting light in a light emitting direction to thereby irradiate an object, the light having a plurality of pattern lights that are parallel to each other;

20 obtaining an image of the object along with a photographing direction; and

deriving a distance between the object and a predetermined position based on an interval between the pattern lights in the image.